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LIFE SUPPORT SYSTEM COST STUDY

ADDENDUM TO

COST ANALYSIS OF CARBON DIOXIDE CONCENTRATORS

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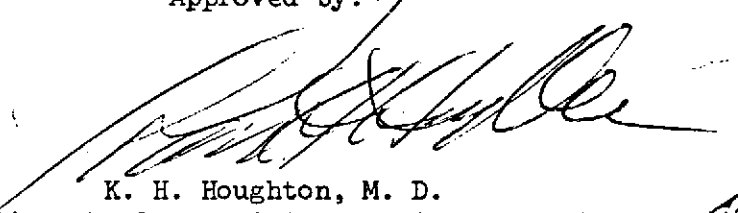
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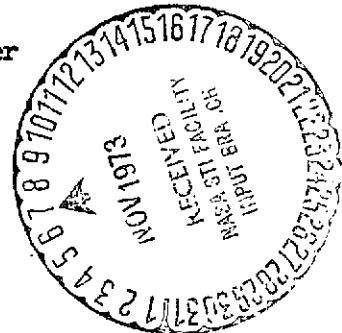

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MCDONNELL DOUGLAS

CORPORATION



COST ANALYSIS OF H₂-DEPOLARIZED CO₂ CONCENTRATOR

1.0 INTRODUCTION

New cost data were received from Life Systems, Inc. (LSI), regarding the Hydrogen-Depolarized Carbon Dioxide Concentrator (HDC). A number of HDC units has been developed at LSI, providing it with high capabilities in this technology. The cost data presented by LSI are based on modifying the concentrator to delete the quick disconnect valves and filters included in the system model defined in MDC-G4631; which resulted in reducing the total cost of the unit. The filters and quick disconnects are considered peripheral or interface type components and their deletion should not affect the data presented in MDC-G4631. However, LSI data are presented for completeness. System description, cost data and a comparison between CO₂ Concentrator costs are presented in the following paragraphs.

2.0 SYSTEM DESCRIPTION:

A schematic of the Hydrogen-Depolarized CO₂ Concentrator system, reflecting the modifications recommended by LSI is presented in Figure 1. The system differs from that presented in MDC-G4631 in that it does not include filters or quick disconnects. Additionally, two heat exchangers are provided as separate units and not as an integral part of the HDC module. A detailed listing of the system components is presented in Table 1. System operation, performance and characteristics are identical to those described in MDC-G4631.

3.0 HDC COST DATA

The Hydrogen Depolarized CO₂ Concentrator system components have been grouped in five groups, designated as I through V, as shown in the system schematic, Figure 1. The recurring and non-recurring CER's used in the calculations were obtained from MDC-G4631 and were based on estimated January 1972 dollars. The consumer price index was used to adjust CER's developed and based on prior years dollar values.

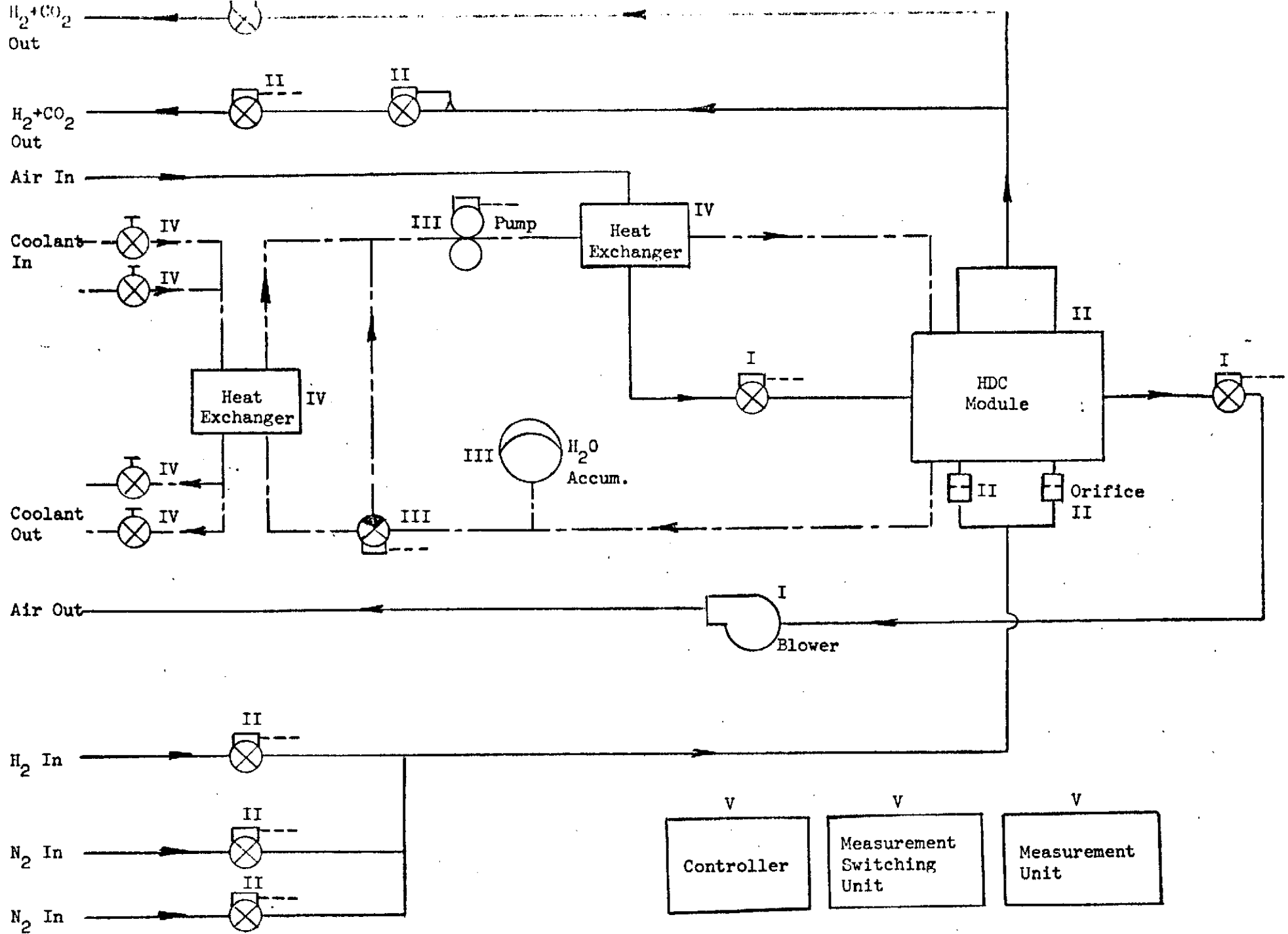


FIGURE 1 - SCHEMATIC OF H_2 -DEPOLARIZED CO_2 CONCENTRATOR

TABLE 1 - H₂-DEPOLARIZED CO₂ CONCENTRATOR COMPONENTS LIST

Component	Quantity	Spares	Unit Weight Lbs.
Module, HDC	2	2	74.5
Valve, Shutoff, Electrical, Motor Driven	5	4	2.5
Valve, Decompression, Electrical, Motor Driven	2	2	2.5
Regulator, Back Pressure	1	1	2.6
Valve, Electrical, Diverter	1	1	3.0
Pump, Liquid	1	1	3.5
Accumulator, H ₂ O	1	1	1.0
Blower, Process Air	1	1	3.4
Heat Exchanger, Air/Liquid	1	1	6.0
Orifice, N ₂	2	1	0.16
Controller, Primary	1	1	20.0
Heat Exchanger, Liquid/Liquid	1	1	5.0
Valve, Shutoff, Manual	4	3	3.9
Measurement Switching Unit, OCS	1	1	15.6
Measurement Unit, OCS	1	1	12.1
TOTALS	25	22	

TABLE 2 - HYDROGEN DEPOLARIZED CONCENTRATOR SYSTEM COST BREAKDOWN

Non-Recurring		Recurring	
System Engineering Design	701,967	Flight Hardware Production	850,445
Subcontractor General and Administrative	362,767	Subcontractor G&A	143,715
Subcontractor Fee	152,245	Subcontractor Fee	60,479
Program Management	58,184	Program Management	21,199
System Engineering	220,943	Sustaining Engineering	30,551
Development Test	144,770		
Qualification Test	106,894		
Reliability Test	172,125		
AGE	776,456		
Tooling	162,866	Sustaining Tooling	26,343
Non-accountable Test Hardware	70,280		
Specifications, Vendor Coordination and Procurement Expense	513,189	Specifications, Vendor Coordination and Procurement Expense	241,448
System Integration	351,825	System Integration	111,449
Prime's Testing	343,829		
Minor Subcontracts	15,992	Minor Subcontracts	73,105
TOTAL	4,154,332		1,558,734

Total Hydrogen Depolarized Concentrator System Cost =

$$4,154,332 + 1,558,734 = \$5,713,066$$

The results of the cost calculations, based on the production of two units, one for actual flight and one for back-up, are presented in Table 2 which shows the breakdown of recurring and non-recurring costs of the HDC system.

4.0 CO₂ CONCENTRATORS COST COMPARISON

A cost comparison between the three CO₂ Concentrators evaluated is presented in Table 3. The cost values tabulated for each of the concentrators represent the cost of producing two flight-type units, one for flight and the second for a back-up. The cost shown for the H₂-depolarized system, which is based on LSI cost data, is predictably lower than the corresponding cost estimate presented in MDC-G4631 due to the deletion of valves and filters from the unit. The H₂-depolarized cost given in MDC-G4631 was estimated to be \$8,791,655. All costs are in estimated January 1972 dollars.

TABLE 3 - CO₂ CONCENTRATORS COST COMPARISON

System	Cost Estimate
Molecular Sieves	\$8,694,438
H ₂ -Depolarized Concentrator	\$5,713,066
Regenerable Solid Desiccant	\$6,839,410
